Next Steps in Sustainable Practices
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"Sustainable Design, Development and Deconstruction"

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Introduction

Many sectors of society have contributed to creating our current world condition. We frequently look to the private sector, nonprofit organizations or to government for the solutions to improve environmental conditions. Education is a significant but largely overlooked player. Institutions of education are well positioned to contribute to the health and well being of society and natural systems through the creation and dissemination of knowledge and values.

Academia has the ability to put forward an agenda that makes sustainability part of its academic pedagogy and of its operational practices.

At Middlebury College, we are engaged in this process both through our curriculum and through operations and capital facilities planning for new construction and renovations.

We have also come to recognize that as a large influential business, the College's responsible actions and decisions regarding the environment can have an impact on the entire region by being a catalyst for change.

Bicentennial Hall -Case Study

- 220,000 square foot - $47 M, approximately $2.00 a square foot, completed in 2000
- Designed to house six science departments and provide classrooms for Middlebury College's intensive summer language programs
- Payette Architects, Dan Arons, project manager now with architectural firm of Tsoi/Kobus & Associates

Environmental Design Features in Bi Hall

- Views to the surrounding environs were enhanced by making them a focal point of the design. The master plan calls for open corners to the quads, and this was respected. Daylight penetrates the vast majority of spaces
- Location near largest residential structures encourages pedestrian campus
- Ample bicycle racks with locations for additional future ones
- The roof design combines substantial insulation with continuous air/vapor system and ventilated "cold roof" for energy efficiency and durability

- Slate roof provides reduced maintenance, as compared with any other roof type. Additionally, slate is a local material, reducing transportation impact
- Recycled plastic lumber used on the flat roof
- Exterior structural wall made of pre-cast concrete so that external walls could be built locally, reducing transportation costs and eliminating the need for temporary enclosure and heating
- Exterior shell walls of stone provide near-zero maintenance and a long life span
- Six-inch air/insulation space between shell and structural exterior walls provides good insulation and effective drainage. A carefully detailed air barrier provides a long lasting (designed to last at least 100 years) and efficient wall structure
- Insulation and mortar screen made from recycled materials
- Triple glazing in thermally broken windows, with R-value of 6-8, provide 2-3 times the insulating value of typical thermal windows
- Combination of effective frame and high R-level eliminates condensation tendency while eliminating standard perimeter (below window) heating in 90% of the building which reduces capital costs, operational costs and maximizes space at interior
- Loading docks are made of recycled materials
- Insulation containing CFCs was designed out of the building and HCFC's were minimized
- Re-use of "contaminated" air as make-up air - this strategy allows the use of air from clean spaces like the Great Hall to be used in labs that have larger fresh air demands
- Glycol heat exchangers in laboratory venting reduces substantial heating and cooling losses
- Process cooling system for the laboratories in place of once-through water cooling was provided in the labs
- Size of the building mechanical equipment was reduced by about 50% from what a run-of-the-mill design process would provide
- Classroom spaces and work spaces built "generically" so their uses can adapt to the school's changing needs with minimal or no reconfiguration
- Linoleum floors used instead of vinyl floors, and some flooring was kept as sealed concrete
- Finished woodwork grown and harvested sustainably through local Vermont Family Forests program (Smart Wood certified)
- 70 % -125,000 board feet within 33 miles of college, 30+ locals, $30,000, 6% premium estimated about 2-3%
- Used natural cork display boards
- Recycling bins designed for easy access and aesthetics

- Used porous paving where appropriate
- Most construction waste was recycled
- All excavated rock was crushed and re-used on site
- Plants and landscaping were chosen to minimize care and chemical application
- Solar-powered lights illuminate the Bicentennial Hall parking lot

Design philosophies:

1) The payback from environmental enhancements to the building were considered across a 10-15 year period, rather than the more typical five-year period. This allowed for more unique design strategies.
2) The building was intended, through flexible and modular design, to be just as useful to the College's future needs as well as its current needs. This means less future construction, less future waste, and less future environmental impact.
3) In addition to utilizing state-of-the-art technologies, the design minimizes maintenance and repair costs. If a surface doesn't need to be repainted or a tree fertilized, considerably less pollution is put into the environment.

<u>**** Lesson learned - Became a prototype for future building and renovation ********</u>

Old Science Center Deconstruction
Middlebury College

1354 tons of materials recovered for reuse, recycling and energy fuel source

Tonnage of Materials Recovered through Deconstruction

Material from the Site	***Qty Reclaimed*** *(tons)*	***Percentage***
Equipment & Building materials salvaged*	10.00	1%
Concrete and glass (crushed)	650.00	47%
Light mixed iron	178.80	13%
Steel (rebar)	368.50	27%
Wood	48.30	3%
Copper	7.85	1%
Aluminum	2.20	.2%
Brass	.08	negligible
Stainless Steel	12.30	1%
Limestone	76.00	5%
C&D debris (landfilled)	36.50	2.6%
TOTAL	1390.53	100%
Total Reclaimed	1354.03	97.4%

*estimated

Old Science Deconstruction - Case Study

- Removal and recycling of 1970's six-story science building to make space for new library
- Several consulting firms hired to look at reuse of building, but cost too high to renovate and retrofit for library weight-bearing demands
- Building also blocked a historic view and access to the campus from the town
- goal to recycle 98% of building's equipment and materials
- T Rex of East Derry, NH contractor hired to remove and recycle 98% of building as goal
- Environmental Affairs office at Middlebury College hired a consultant to track the deconstruction project and record material removal/recycling process
- Hazardous waste removal by professionals with only one container found after sweep completed
- Air compressor and other parts of systems salvaged for college
- Some display cases and 80% of scientific equipment moved to Bicentennial Hall, the new science center
- Chairs, computers, lab equipment, beakers donated to schools throughout the state
- Landscaping moved numerous trees from the site, protected others from machinery and will have a professional come in to perform root cuts to save tress that will be impacted on site - these efforts saved 60% of the trees on the existing site
- Process of demolition is like mining building for materials since it's basically made up of only a few basic materials - says Chad Malone, Middlebury alum and son of owner of T Rex Wood

Over 97% Reclaimed

- Fifteen area schools received thousands of dollars worth of science and classroom equipment
- An air compressor recovered from Old Science is now in use at the Natatorium
- Nearly 500 tons of crushed concrete became site fill for the new Recycling Center

New England scrap metal dealers will market light iron, rebar, copper, aluminum, brass and stainless steel to domestic and export markets. Stainless steel will be made into sinks and countertop; aluminum becomes house siding; and copper, the "gold" of deconstruction, becomes pipe and wire again. Light metal goes into car panels. Heavy metal is turned back into beams and rebar into rebar. The wood became fuel chips for New England-based wood burning power plants, aggregate for road base within landfills, and a soil-textured material used by landfills in regions where appropriate daily cover soils are unavailable. Limestone will be sold in the spring for landscaping. Ground glass and concrete all stays on campus as fill.

Pros

- Keeps previously harvested resources in the economy
- Saves landfill space for materials that lack effective reuse or recycling options
- Supports sustainable systems – life cycle versus linear
- Reduces negative impacts on the community of removing a large building

(noise, dust, large truck traffic)

Cons

- Limited local markets for some of the materials and few deconstruction firms
- More time consuming and building realities unknown until deconstruction underway

What We Learned

- Designing and constructing appropriate buildings from the start maximizes initial material and fiscal resource investment and provides opportunities for new uses
- Positive community response towards deconstruction as a technique for building removal - process is the friendliest method to take down a building
- Substantial harvesting of material resources is possible through deconstruction - national data suggests demolition only recovers 25-30% for recycling
- Data collection and learning process component of innovative projects must be included in contract specifications
- Rural Vermont lacks infrastructure for local marketing of recovered building materials, but could be created if the amount of salvaged materials continues or increases
- Deconstruction will provide more raw materials as natural resources become less available and more costly - old buildings are becoming the mines and forests of the future
- Project debriefing by Facilities Planning will assist College and others facing similar tasks in evaluating how to improve on the deconstruction process

Practices and Policies -

- Guiding Principles for Sustainable Design, endorsed by the Trustees Building & Grounds Committee in May 2000
- Project Review Committee - established to develop standards and process (Framework for Implementation) and a committee to review and influence new construction and renovation projects. Composed of staff, faculty, administrators and an outside consultant
- Framework for Implementation* also incorporates LEED (US Green Building Council) but the Framework is more specific having standards that exceed LEED, goals that are part of the College's culture and guidelines that are more geared to the region - the Framework is nearly complete. It will become part of the College's Master Plan and approved by the Trustees.
- The new library architects Gwathmey Siegle & Associates expect to obtain a silver or gold LEED rating with the US Green Building Council
- Atwater Commons, a new residential hall, is expected to have natural ventilation for cooling instead of air conditioning, a green roof and ecological landscaping with KieranTimberlake Associates (architects) and ecological landscape planning and design firm of Andropogon Associates Ltd., both from Philadelphia.

- Middlebury College also developed a C & D waste management policy for all contractors - part of specs with additional fines for any waste violations

Obstacles and Opportunities

- Culture: Culture of institutions of higher education is rigid and unyielding. Need to build on success of past, but evolve and adjust process - build best buildings we know how to make last 100 years, include operational cost with capital costs - requires life cycle analysis and modeling. Pride in building process and sustainable development in Vermont worked to shift the culture
- Professionals: College's engineers are not quite there yet, other professionals reluctant. Need to be a good client with clear and specific desired goals and outcomes - best projects are client-driven, but enable the professionals to use creativity and expertise with clear guidelines from the client. Professionals come along quickly and then use green design and technology in the project to show case as they advertise themselves elsewhere - this is a case in which institutions of higher education are influencing the professionals
- Technology and Materials: Not always there yet, careful not to take risk with new untested systems, but the field is responding quickly to demands. Therefore, the technology is changing fast. In Vermont Middlebury College has been able to create new markets and the producers followed by meeting the request for local sustainable materials. Playing this kind of capacity building role takes more time, planning and communication between the potential producers and the College. It is not like going to the lumberyard or to a supply catalogue. Green certified wood in Vermont needs to be harvested in time to be used, so discussions about what is needed and when have to take place very early in the process
- Costs: Need to change how to estimate building At Middlebury if five-year pay back it is a sure things. If 15-25 year will consider for environmental reasons. Requires enlightened and responsible fiscal management
- Process: Involves more operations staff, Project review Committee and others in the early program development stage and throughout the process. More inclusive, better advice, stays on time table and within budget

Middlebury College's Sustainable Design and Construction Guiding Principles and Framework for Implementation will be available on our website in April 2002 at http://www.middlebury.edu/facilities/project_review_committee.html.

On-line Resources

- Ball State University "Greening of the Campus" Conference (http://www.bsu.edu/greening/)

- Big Green: Sustainable Design and Construction of Large-Scale Projects, Discussion Group and Building Database (http://www.biggreen.org/)

- Eley Associates – architectural and engineering consulting firm http://www.eley.com/

- Environmental Building News (http://www.buildinggreen.com/)

- Environmental Design & Construction – free subscription (http://www.edcmag.com/)

- Greenclips: Sustainable Building Design News Digest (http://www.greendesign.net/greenclips/)

- International Journal of Sustainability in Higher Education http://www.emeraldinsight.com/ijshe.htm

- Leadership in Energy and Environmental Design - LEED Green Building Rating System (http://www.usgbc.org/programs/leed.htm)

- Minnesota Sustainable Design Guide (http://www.msdg.umn.edu/default.htm)

- MIT Green Building and Design (http://web.mit.edu/julz/www/Green_Building/)

- Oikos: Green Building Source (http://www.oikos.com) and Green Building Discussion Group (http://www.oikos.com/resources/maillist.html)

- SUNY Buffalo - UB Green - (http://wings.buffalo.edu/ubgreen/)

- SUNY Buffalo Environmental Stewardship and the Green Campus: The Special Role of Facilities Managers, by Walter Simpson, UB Energy Officer (http://wings.buffalo.edu/ubgreen/content/resources/envstewardship.html)

- US Green Building Council (http://www.usgbc.org/)

Articles

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- Seif, Amy. *Certified Wood Reaches Campus,* In Business, pp 31-33, January/February 1999.
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